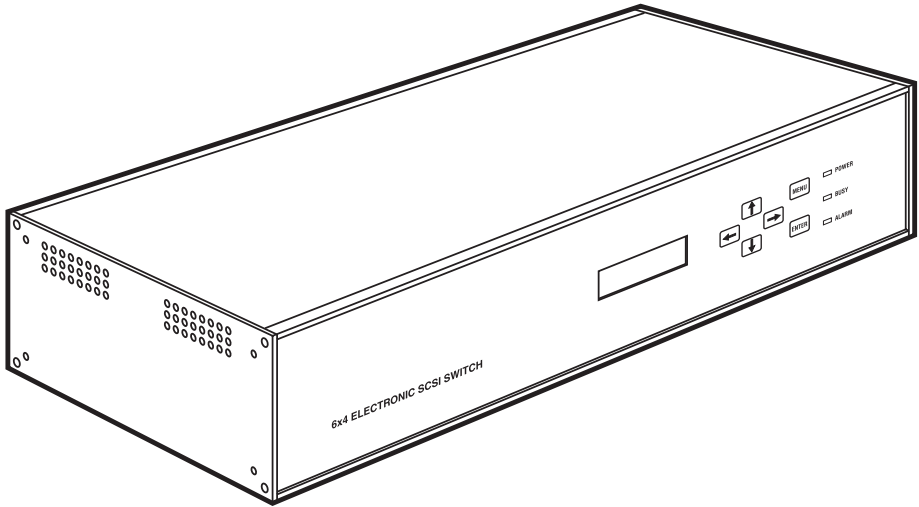




6 x 4 Electronic SCSI Switch



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Mailing address: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
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This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

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This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

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This equipment complies with the requirements of the European EMC directive 89/336/EEC.



**NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT****INSTRUCCIONES DE SEGURIDAD**

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

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Contents

Chapter	Page
1. Specifications	7
2. Introduction	10
2.1 About the SCSI Switch	10
2.2 Features	10
2.2.1 LCD Panel.....	11
2.2.2 Front-Panel Controls	11
2.3 Technical Description.....	11
2.3.1 Available SCSI Switch Interfaces	11
2.3.2 General Hardware Description.....	12
2.3.3 Ultra2 SCSI Compatibility	12
2.3.4 SCSI Switch Installation.....	12
3. Installation	15
3.1 What's Included	15
3.2 AC Line Voltage	15
3.3 Switch Placement	15
3.4 Power Equipment Off.....	15
3.5 SCSI Interface Cabling	16
3.6 RS-232 Serial Port Cabling	16
3.7 Ethernet LAN Port Cabling	16
4. Operator Controls and Indicators	17
4.1 AC Power Switch	17
4.2 LCD Display, Keypad, and Indicators	17
4.2.1 LCD Display	17
4.2.2 Keypad	18
4.2.3 Indicators	18
4.3 LCD Display Control Menus	19
4.4 SCSI Switch Port Configuration.....	22
4.5 SCSI Switch Default Configuration	22
5. Configuration and Operation	23
5.1 SCSI Cable Interface Requirements	23
5.2 Internal Terminator Selection	23
5.3 Selecting Internal Terminator Power	24
5.4 Selecting External Terminator Power	24
5.5 Serial-Port Pinout	25
5.6 LAN/Serial Port Commands	26
5.7 ASCII Character Reference for SCSI Switch Box Selection.....	32

Chapter	Page
5. Configuration and Operation (continued)	
5.8 Graphical User Interface (GUI)	32
5.9 Connecting Multiple SCSI Switches	33
5.10 Rackmount Installation	33
5.10.1 Installation Procedure.....	33
5.10.2 Rackmount Considerations	33
5.11 Typical Applications	34
5.12 Network Control of SCSI Switch	35
5.12.1 LAN-Port Configuration	35
5.12.2 Cfgswitch Utility.....	36
5.12.3 Apconcmd Utility.....	37
6. SCSI Technical Information	38
6.1 SCSI Basics	38
6.1.1 SCSI-1	38
6.1.2 SCSI-2	38
6.1.3 SCSI-3	38
6.1.4 Signal Wiring	38
6.1.5 Common Problems	39
6.1.6 Passive Terminators	39
6.1.7 Active Terminators.....	39
6.2 SCSI Installation Tips	39
6.3 SCSI Interface Signal Descriptions	40
7. Troubleshooting.....	47
7.1 Calling Black Box	47
7.2 Shipping and Packaging.....	47

1. Specifications

SCSI Interface

Maximum Port Switching Delay: 3 ns

Maximum Signal Skew: 2 ns

Internal Terminator Power: 1 amp

Rear-Panel Connectors: 68-pin high-density

SCSI-1, SCSI-2, & SCSI-3, SPI-2 compatible (also Ultra160 SCSI [“Ultra3 SCSI”] for SW487A-R2); asynchronous and synchronous compatible; conforms to ANSI X3.131 and X3T9.2

Single-Ended (SE) SCSI (SW487A-R2 Only)

Maximum Data Rate (8-bit Narrow): 20 MBps

Maximum Data Rate (16-bit Wide): 40 MBps

Maximum Port Cable Length: 6 meters (20 ft.)

Internal Terminator Impedance: 100 ohms

Terminator Disconnect Capacitance: 4 pF

Active Internal Bus Termination

Differential (DE) SCSI (SW485A Only)

Maximum Data Rate (8-bit Narrow): 40 MBps

Maximum Data Rate (16-bit Wide): 80 MBps

Maximum Port Cable Length: 25 meters (82 ft.)

Internal Terminator Impedance: 110 ohms

Terminator Disconnect Capacitance: 5 pF

Passive Internal Bus Termination

6 x 4 ELECTRONIC SCSI SWITCH

Low-Voltage Differential (LVD) SCSI (SW487A-R2 Only)

Maximum Data Rate (8-bit Narrow): 40 MBps for Ultra2 SCSI (narrow transfers aren't officially supported in the Ultra160 SCSI standard)

Maximum Data Rate (16-bit Wide): 160 MBps

Maximum Port Cable Length: 25 meters (82 ft.)

Internal Terminator Impedance: 105 ohms

Terminator Disconnect Capacitance: 3 pF

Active Internal Bus Termination

Serial Interface

Baud Rate: 9600 or 19,200 bps

Data Format: No parity, 8 bits, 1 stop bit (fixed)

Maximum Cable Length: 15 meters (50 ft.)

Rear-Panel Connectors: DB9

LAN Port

Protocol: TCP/IP

Interface: Ethernet

Data Rate: 10 MBps

Rear-Panel Connector: RJ-45

Agency Approvals

UL®, CUL, FCC Class A, CE

Physical

Temperature: 32 to 149°F (0 to 65°C)

Humidity: Up to 90% noncondensing

Power: 105 to 240 VAC \pm 10% (25 watts)

Size: 3.5"H x 16.8"W x 12"D (8.9 x 42.7 x 30.5 cm)

Weight: 5 lb. (2.3 kg)

2. Introduction

2.1 About the SCSI Switch

The 6 x 4 Electronic SCSI Switch is a high-performance electronic crosspoint switch for use with the SCSI (Small Computer System Interface) bus. It enables groups of four and six independent SCSI buses to be selected and electrically connected in any combination via internal electronic switching circuits. The 6 x 4 Electronic SCSI Switch eliminates the need to swap and reconfigure SCSI cables and bus terminators when alternate system configurations are required.

In conjunction with the 6 x 4 Electronic SCSI Switch's dual RS-232 serial interface, a Graphical User Interface (GUI) allows the system administrator to remotely operate and control SCSI port configuration and termination, report SCSI-bus activity, gather performance statistics, and set internal temperature points for alarm notification. Standard DOS or modem software can also be used to control the switch using simple ASCII control commands.

Up to thirty-two 6 x 4 Electronic SCSI Switches can be connected together and controlled by one serial port.

2.2 Features

- Ultra2, Ultra, and Fast SCSI compatible. SW487A-R2 is Ultra160 SCSI (a.k.a. "Ultra3 SCSI") compatible.
- 80-MBps or (SC487A-R2 only) 160-MBps throughput.
- Easy-to-use LCD panel.
- Daisychain up to 32 switches.
- Share up to 90 SCSI peripherals.
- SW485A supports differential SCSI. SW487A-R2 supports single-ended or LVD SCSI.
- Transparent electronic switching.
- LAN port for TCP/IP-based network control, RS-232 ports for serial control.
- Does not require SCSI-bus ID.
- User-installable.

2.2.1 LCD PANEL

The 6 x 4 Electronic SCSI Switch features an easy-to-use, menu-driven LCD panel with soft-touch MENU, ENTER, and directional keys. The LCD is lighted, which allows for easy viewing and operation.

2.2.2 FRONT-PANEL CONTROLS

- Set and configure SCSI ports.
- Set termination.
- Set switch number.
- View power-supply status.
- View internal temperature.
- Set internal-temperature alarm.
- Set serial-port configuration.
- Display SCSI-bus busy status.
- Display port configuration.

2.3 Technical Description

2.3.1 AVAILABLE SCSI SWITCH INTERFACES

The 6 x 4 Electronic SCSI Switch is available in the following configurations:

- Single-ended/LVD interface (SW487A-R2)
- Differential interface (SW485A)

NOTE

Make sure that the SCSI Switch you're installing is used with the appropriate interface. Single-ended/LVD and differential SCSI devices cannot be installed on the same switch unless a SCSI differential converter is used.

2.3.2 GENERAL HARDWARE DESCRIPTION

The 6 x 4 Electronic SCSI Switch's rear panel identifies each of the independent SCSI ports. SCSI ports A, B, C, and D have two daisy-chained connectors per port, and SCSI ports 1, 2, 3, 4, 5, and 6 have single connectors for installation of SCSI devices. You can install the SCSI Switch at any point on the SCSI bus.

Each port has internal termination that can be turned on or off from the LCD panel. External "termination power" (TERMPWR) for devices and terminators are provided by internal resettable fuses.

The SCSI Switch does not require a device ID and is completely transparent to all computers and peripherals on the SCSI bus. No additional software is needed for installation and operation. A universal switching power supply automatically adapts to input voltages between 105 VAC and 240 VAC.

2.3.3 ULTRA2 SCSI COMPATIBILITY

The SCSI Switch supports Ultra2 SCSI, 80-MBps (wide) SCSI host adapters, computers, and peripherals in asynchronous and synchronous mode. (SW487A-R2 also supports Ultra160 SCSI, 160-MBps devices.) The SCSI Switch conforms to ANSI X3.131 and X3T9.2 specifications for single-ended devices. Disconnect and reselect functions are fully supported to ensure complete SCSI compatibility.

2.3.4 SCSI SWITCH INSTALLATION

Ports A, B, C, and D are fully bidirectional to ports 1, 2, 3, 4, 5, and 6 (see Figure 2-1). You determine where to connect computers, host adapters, and peripherals. In general, if daisy-chained ports are required for connection to external peripherals, use ports A, B, C, and D. See Figure 2-2 for a typical installation.

NOTES

- 1. For proper operation of any SCSI bus, there must not be a "hanging" line or cable. Termination should be enabled on active SCSI ports that are not connected through to another port.**
- 2. Connections can be made to either connector on the appropriate port.**
- 3. In Figures 2-1 and 2-2, "Term" indicates where terminators should be installed.**

The LCD panel is used to select port connections and enable or disable each internal SCSI-port terminator. Refer to **Chapter 4** for complete instructions on operating the LCD keypad.

You can selectively enable or disable any internal terminator to meet system configurations and requirements.

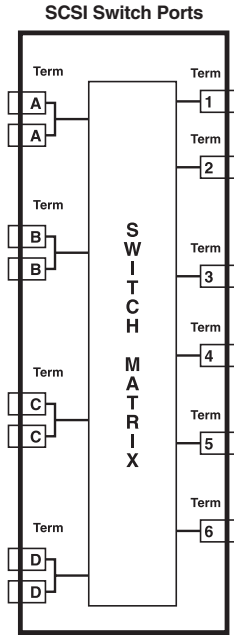


Figure 2-1. Electronic SCSI Switch block diagram.

6 x 4 ELECTRONIC SCSI SWITCH

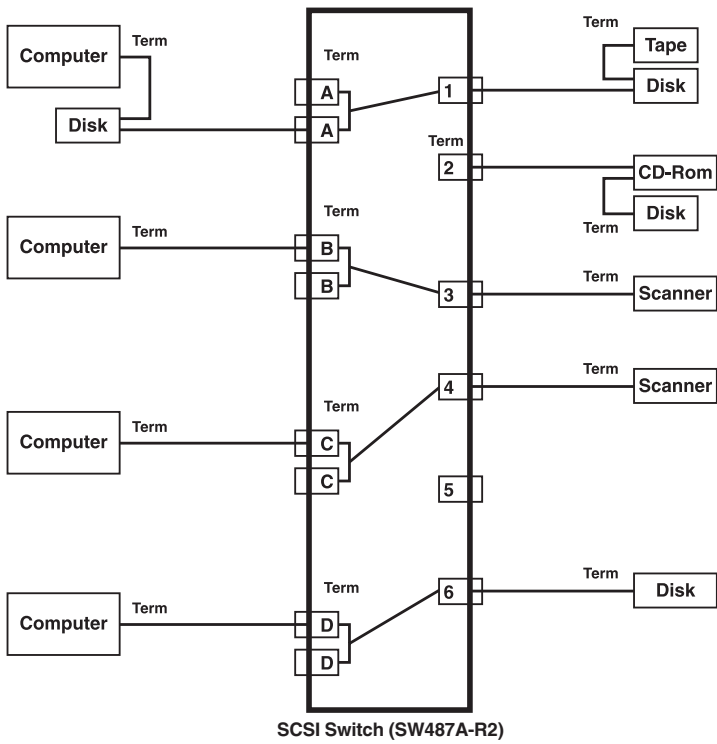


Figure 2-2. Typical switch installation.

3. Installation

3.1 What's Included

- (1) 6 x 4 Electronic SCSI Switch
- (1) AC power cord
- (1) 10-ft. (3-m) DB9-male-to-DB9-female RS-232 adapter
- (1) DB9-male-to-DB25-female RS-232 adapter
- (1) SCSI Switch control software CD-ROM
- Rackmount handles and screws
- Bottom feet
- This users' manual

If anything is missing or damaged, call Black Box at 724-746-5500.

3.2 AC Line Voltage

You can connect the SCSI Switch to any AC input voltage between 105 and 240 volts. Unless otherwise specified, the switch will be shipped with a 110-volt power cord for use in the USA. For a power cord that will work in your country (outside the USA), call Black Box Technical Support.

3.3 Switch Placement

Place the SCSI Switch in a convenient location near the host computer or peripherals. If you'll be placing it on a flat surface, put the feet on the bottom of the switch. If you'll be rackmounting it, use the procedure in **Section 5.10**. Keep SCSI cable lengths short to provide the best performance and reliability. Make sure that the dual fans and ventilation slots on the sides of the switch receive adequate airflow. Do not place the switch on or near any devices that generate excessive heat.

3.4 Power Equipment Off

Power off all equipment and peripherals connected to the SCSI interface before installing cables or terminators.

3.5 SCSI Interface Cabling

Both versions of the 6 x 4 Electronic SCSI Switch are supplied with 68-pin shielded high-density SCSI-2 connectors. Single-ended devices can have cable lengths up to 20 ft. (6 m). Differential or low-voltage differential (LVD) devices can be connected with up to 82 ft. (25 m) of cable.

Connect the host adapter or peripheral to the rear-panel connector using the proper SCSI cable. **Section 6.1** describes standard SCSI-cable interface requirements. When you connect devices to ports A through D, use one of the port connectors, not both.

NOTE

Do not intermix single-ended/LVD and differential devices on any SCSI chain unless a SCSI differential converter is used to convert from one bus type to the other.

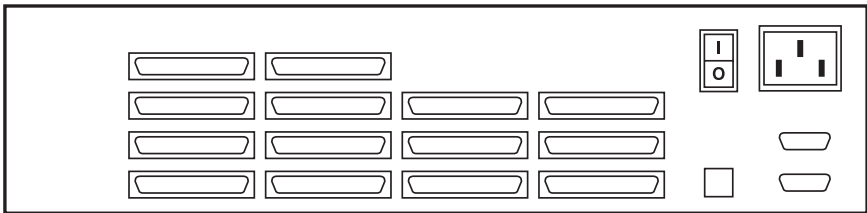


Figure 3-1. The SCSI Switch's rear panel.

3.6 RS-232 Serial Port Cabling

The SCSI Switches have a DB9 female RS-232 serial port on their rear panel, pinned so that you can use a straight-through-pinned DB9 male-to-female serial cable (such as the one provided with the SCSI Switch) to connect it to the DB9 male serial ports on a PC. Pins 1, 2, 3, 5, and 6 (CD, TD, RD, SGND, and DSR respectively) are functional on the SCSI Switch's RS-232 port; Pins 4 and 8 (DTR and CTS) are tied together; and Pins 7 and 9 (RTS and RI) have no function.

3.7 Ethernet LAN Port Cabling

The SCSI Switches have a RJ-45 female 10BASE-T Ethernet port on their rear panel. Use a standard straight-through-pinned twisted-pair cable (CAT5 or higher) to connect this port to an Ethernet hub, switch, or router. To connect this port directly to a 10BASE-T port on a computer, you'll need to use a cross-pinned cable.

4. Operator Controls and Indicators

4.1 AC Power Switch

The AC power switch is located on the Switch's rear panel. Move it to the “|” position to turn on the SCSI Switch.

NOTE

Always turn on the SCSI Switch before powering SCSI devices and computers. This will ensure that devices are found when the system boots up.

4.2 LCD Display, Keypad, and Indicators

4.2.1 LCD DISPLAY

The LCD display shows the selection parameters available.

>	SET PORTS SET TERMINATION DISPLAY PORTS DISPLAY ACTIVITY
>	DISPLAY POWER, TEMP FRONT PANEL LOCK SET SERIAL PORTS SET SWITCH NUMBER
>	SET TEMP LIMIT DISPLAY VERSION

Figure 4-1. The LCD display's main menu.

6 x 4 ELECTRONIC SCSI SWITCH

4.2.2 KEYPAD

Use the keypad to select menu and setup parameters for the SCSI Switch.

- **MENU:** Returns to the SCSI Switch setup and configuration menu.
- **ENTER:** Selects the highlighted setup parameter.
- **UP, DOWN, RIGHT, LEFT Arrows:** Scrolls the cursor to enable menu selection.

4.2.3 INDICATORS

The indicators provide SCSI Switch status information.

- **POWER:** Indicates that the SCSI Switch is powered.
- **BUSY:** Indicates that there is SCSI activity on one or more SCSI ports.
- **ALARM:** A visual and audible alarm indicates a failure of an internal power supply or that the SCSI Switch has exceeded the set temperature limit.

NOTE

To disable the audible alarm, press the front-panel MENU key. The ALARM light will remain lit until the condition is corrected.

4.3 LCD Display Control Menus

SET PORTS

SET PORTS						
	1	2	3	4	5	6
A	*					
B		*				
C			*			
D					*	

SET TERMINATION

SET TERMINATION			
A	B	C *	D
1	2	3 *	4
5 *	6		

DISPLAY PORTS

DISPLAY PORTS					
A	1	A	2	A	3
A	1	A	2	A	3
B	1	B	2	B	3
C	1	C	2	C	3
D	1	D	2	D	3
A	4	A	5	A	6
B	4	B	5	B	6
C	4	C	5	C	6
D	4	D	5	D	6

6 x 4 ELECTRONIC SCSI SWITCH

SET SERIAL PORTS

SET SERIAL PORTS

COM 1	9600 *	19200
COM 2	9600 *	19200
DAISY CHAIN	Y *	N

SET SWITCH NUMBER

SET SWITCH NUMBER
01
USE UP/DOWN KEYS

DISPLAY POWER TEMPERATURE

DISPLAY POWER TEMP

PWR SUPPLY GOOD
+25.5°C

SET TEMP LIMIT

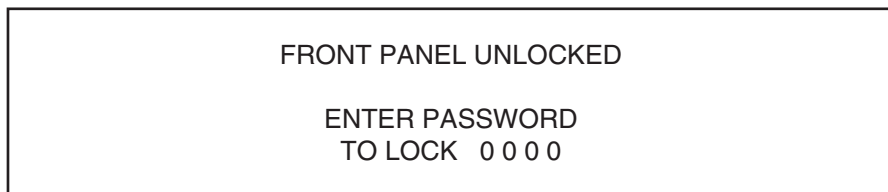
SET TEMP LIMIT
MAX +40°C

CURRENT TEMP +26.0°C

DISPLAY BUS ACTIVITY



FRONT PANEL LOCK



DISPLAY VERSION



In the DISPLAY VERSION panel:

- “HVD,” “LVD,” or “SE” at bottom left indicates the current SCSI-bus interface mode.
- “x” at top right indicates that the serial ports are locked.
- “LAN” at bottom right indicates that the LAN port is active.

4.4 SCSI Switch Port Configuration

The 6 x 4 Electronic SCSI Switch has an internal memory device that retains the current configuration and setup information. Switch port, termination, serial port, and control parameters are saved as they are entered on the front panel.

4.5 SCSI Switch Default Configuration

The default configuration, as shipped from the factory, is defined below.

PORTS: A1, B2

TERMINATION: All Off

SERIAL PORTS: 9600 bps

SWITCH NUMBER: 01

TEMPERATURE ALARM: 40° Celsius (104°F)

FRONT PANEL: Unlocked, password 0000

5. Configuration and Operation

5.1 SCSI Cable Interface Requirements

The 6 x 4 Electronic SCSI Switch can be installed at any point on the SCSI bus. Always use high-quality cables for optimum computer performance and reliability.

The SW485A differential switch contains 68-pin high-density connectors for up to 80-MB-per-second wide Ultra SCSI and Ultra2 SCSI computers and peripherals. The maximum cable distance should not exceed 82 ft. (25 m).

The SW487A-R2 single-ended/low-voltage differential switch contains 68-pin high-density connectors for up to 160-MB-per-second wide Ultra SCSI, Ultra2 SCSI, and Ultra160 SCSI computers and peripherals:

- *Low-Voltage Differential (LVD):*
When operating with LVD devices, the SW487A-R2 supports 160-MBps wide Ultra160 SCSI computers and peripherals. The maximum cable distance for LVD should not exceed 82 ft. (25 m) total length.
- *Single-Ended (SE):*
When operating with SE devices, the SW487A-R2 supports 40-MBps wide Ultra SCSI computers and peripherals. The maximum cable distance for SE should not exceed 20 ft. (6 m) total length.

Black Box offers standard and custom SCSI cables for connecting the SCSI Switch to host devices and peripherals. Call Black Box Technical Support for details.

5.2 Internal Terminator Selection

The 6 x 4 Electronic SCSI Switch contains internal SCSI-bus terminators for each port. Termination is required at both ends of a SCSI bus for proper operation. Each port can have its internal terminator enabled or disabled from the front-panel display and keypad.

Refer to Figure 5-1 to select internal termination.

NOTE

Data errors will result if more than two sets of terminators are installed on any SCSI bus (see Figures 2-1 and 2-2).

5.3 Selecting Internal Terminator Power

Onboard SCSI Switch terminators can be powered by internal 5-volt power or externally from SCSI-bus “termination power” (TERMPWR).



Figure 5-1. Internal terminator-power jumpers.

Table 5-1. Jumper settings for internal termination.

E1 - Port A	E3 - Port C	E5 - Port 1	E7 - Port 3	E29 - Port 5
E2 - Port B	E4 - Port D	E6 - Port 2	E8 - Port 4	E30 - Port 6

NOTE

The standard factory default connects internal terminators to internal 5-volt power.

5.4 Selecting External Terminator Power

The SCSI Switch can supply external terminator power via an internal resettable fuse. This fuse supplies 1 amp at 5 volts to the TERMPWR signal. The SCSI Switch contains internal protection and will not be affected if other SCSI devices provide terminator power.



Figure 5-2. External terminator-power jumpers.

Table 5-2. Jumper settings for external termination.

E19 - Port A	E23 - Port C	E20 - Port 1	E24 - Port 3	E27 - Port 5
E21 - Port B	E25 - Port D	E22 - Port 2	E26 - Port 4	E28 - Port 6

NOTE

The standard factory default connects internal terminators to internal 5-volt power.

5.5 Serial-Port Pinout

The 6 x 4 Electronic SCSI Switch has two RS-232 serial ports, using female DB9 connectors, which allow external control of the switch. The connectors are compatible with standard RS-232 modem cables. The serial ports can be configured to operate separate communications ports or as daisy-chained ports.

Daisy-chained mode allows one computer or terminal to communicate with multiple 6 x 4 Electronic SCSI Switches.

Table 5-3. Rear-panel RS-232 connector pinout.

Signal	Description	DB9 Pin	DB25 Pin
DCD	Data Carrier Detect	1	8
RXD	Receive Data	2	3
TXD	Transmit Data	3	2
DTR	Data Terminal Ready	4	20
GND	Signal Ground	5	7
DSR	Data Set Ready	6	6
RTS	Request to Send	7	4
CTS	Clear to Send	8	5
RI	Ring Indicator	9	22

5.6 LAN/Serial-Port Commands

You can use simple ASCII-character commands to control the SCSI Switch through either its LAN port (by opening a socket connection to port 3001) or one of its RS-232 serial ports. For serial control, set your computer's serial port this way:

- a. Baud rate: 9600 (the switch's factory default) or 19,200 bps.
- b. Data format: 8 data bits, 1 stop bit, no parity.
- c. Transmission mode: Half-duplex.

So, for example, the DOS command to set a PC for serial communication with the switch would be `MODE COMx 9600, N, 8, 1`. Whether you're using a LAN or serial connection, commands have the same syntax (format):

- a. Start sequence: ASCII `<cr>` (carriage return) followed by two slashes ("`//`")
- b. Switch box number (you need this even if you have only one SCSI Switch):

Box 1 - 7C hex (ASCII " <code> </code> ")	Box 3 - 7E hex (ASCII " <code>~</code> ")
Box 2 - 7D hex (ASCII " <code>}</code> ")	Box 4 - 7F hex (ASCII " <code></code> ")
- c. Port selection: Port A to port 1: "`A1`"; Port C to port 4: "`C4`"; and so on.

NOTE

1. More than one numbered port can be connected to port A or B. For example, to connect port A to both port 1 and port 3, and port B to both port 2 and port 4, transmit "`A13B24`."

2. "`0`" clears (disconnects) all numbered ports. For example, "`A0`" clears all numbered ports connected to port A.

- d. Connection or disconnection type:
ASCII "`K`" connects the specified ports and strictly adheres to SCSI rules.

NOTE

With "`K`," if port A, B, C, or D is not specified, no action will be taken on that port. If a connection is selected (for example, "`A1`"), that connection will be made, and other numbered ports will be disconnected from that lettered port. For example, entering "`A2`" when port A is connected to port 5 will disconnect port A from port 5 and connect it to port 2.

ASCII "`N`" connects the specified ports without breaking existing connections.
ASCII "`F`" disconnects the specified ports.

- e. End sequence: ASCII `<cr>`

So, for example, the complete command to connect the first SCSI Switch's port A to port 5 and its port B to ports 1 and 4 would look like this: `<cr>//|A5B14K<cr>`

Table 5-4. SCSI Switch commands.

Command	Cmd. Char.	Example Command String	Example Result or Response
Select Port	K	<cr> A1K<cr>	
Report Port Status	S	<cr> S<cr>	" a2b0K"
Select Terminator	k	<cr> A1k<cr>	
Report Terminator Status	s	<cr> s<cr>	" abcd13k"
Lock Front Panel	L	<cr> L<cr>	
Unlock Front Panel	U	<cr> U<cr>	
Report Model, S/N, and Date of Manufacture	?	<cr> ?<cr>	" text..."
Report Alarm Status	a	<cr> a<cr>	" a00"
Report Temperature	t	<cr> t<cr>	" t+23.5" (Celsius)
Report Performance	P	<cr> P<cr>	" PAABCCDD 112233445566"
Report SCSI-Bus Inactivity	I	<cr> I<cr>	"2C71" (hex, = 1137.7 s or 19 m)
Yank on SCSI Reset Line	Y	<cr> AC3Y<cr>	Ports A, C, and 3 reset

6 x 4 ELECTRONIC SCSI SWITCH

Table 5-4 (continued). SCSI Switch commands.

Command	Cmd. Chars.	Example Command String	Example Result or Response
Enable/Disable Alarm	OA	<cr> OA0<cr>	Alarm enabled
Set Baud Rate	OB	<cr> OB10<cr>	COM2 = 9600 bps
Set Serial-Port Mode	OC	<cr> OC0<cr>	Daisychain enabled
Set Switch Number	OD	<cr> OD06<cr>	Switch # = 6
Set Lock/Unlock Password	OP	<cr> OP3156<cr>	Password = 3156
Set Temperature Limit	OT	<cr> OT45<cr>	Max. temp. = 45°C
Report Revision	R	<cr> R<cr>	"2024610"
Lock Serial Ports	OL	<cr> OL3156<cr>	OL1 pass OL0 fail
Unlock Serial Ports	OU	<cr> OU3156<cr>	OU1 pass OU0 fail
Report Serial-Port Lock Status	OS	<cr> OS<cr>	OS1 lock OS0 open

EXPANDED LIST OF COMMANDS:

- a. Select SCSI
- Port**
- Matrix:

example command: <cr>||A3B2D5K<cr>

report: none

NOTE**K - Connects specified ports, but also breaks former connections and maintains proper termination as per SCSI rules.****N - Connects specified ports without regard for former connections or termination.****F - Disconnects the specified ports.**

- b. Report SCSI Port Matrix Assignment
- Status**

example command: <cr>||S<cr>

example report: ||A3B2C0D5K<cr>

- c. Select SCSI
- Terminator**
- Matrix:

example command: <cr>||CD1356k<cr>

report: none

- d. Report SCSI
- Terminator**
- Status

example command: <cr>||s<cr>

example report: ||CD1356k

- e.
- Lock**
- Front Panel

example command: <cr>||L<cr>

report: none

- f.
- Unlock**
- Front Panel

example command: <cr>||U<cr>

report: none

- g. Report
- Model**
- ,
- Serial Number**
- , and
- Date of Manufacture**
- :

example command: <cr>||?<cr>

example report: ||SW487A-R2 202801150 10-15-02

SW487A-R2 = model number

20281150 = serial number

10-15-02 = date of manufacture (mm-dd-yy)

- h. Report
- Alarm**
- Status:

example command: <cr>||a<cr>

report format: ||axy (x and y = ASCII 1 or 0)

x: 0 = OK, 1 = Overtemperature

y: 0 = OK, 1 = Power-supply failure

i. Report **Temperature**:

example command: <cr>||t<cr>

example report: ||t+19.5

+19.5 = +19.5°C, +67°F

j. Report SCSI-Bus **Performance**:

example command: <cr>||P<cr>

report format: ||P<aabbccdd112233445566<cr>

For ports A through D and 1 through 6 respectively, aa through dd and 11 through 66 = ASCII representations of 8-bit hexadecimal values from 00 to FF, where 00 represents 0% busy (completely idle) and FF represents 100% busy

k. SCSI Bus **Inactivity** to SCSI Report:

example command: <cr>||I<cr>

report format: 1111 2222 3333 4444 5555 6666

For ports 1 through 4 respectively, 1111 through 6666 = ASCII representations of 16-bit hexadecimal values that express the length of time in tenths of seconds that the port has been inactive (not transmitting or receiving data). For example, "0A73" = 0 x 4096 (16³) + 10 x 256 (16²) + 7 x 16 + 3 tenths of seconds = 267.5 seconds = 4 minutes 27.5 seconds.

l. **Yank** on SCSI Reset line:

example command: <cr>||BD235Y<cr>

report: none

m. Enable/Disable Audible **Alarm**:

example command: <cr>||OAx<cr> [x = ASCII 1 or 0]

x: 0 = enable alarm, 1 = disable alarm

report: none

n. Set Serial-Port **Baud Rate**:

example command: <cr>||OBxy<cr> [x and y = ASCII 1 or 0]

x: 0 = COM1, 1 = COM2

y: 0 = 9600 bps, 1 = 19,200 bps

report: none

o. Set Mode of Serial (**Comm**) Port for RS-232 Port 2:

example command: <cr>||OCx<cr> [x = ASCII 1 or 0]

x: 0 = use Port 2 for daisy chaining, 1 = use Port 2 as a second serial port

report: none

Note: This command has no effect if the LAN port is enabled, which disables RS-232 Port 2.

- p. Set Switch (**Device**) Number:
example command: <cr>||ODxx<cr>
xx = ASCII representation of decimal value from 01 through 32
report: none
- q. Set “Lock/Unlock Front **Panel**” Password:
example command: <cr>||OPxxxx<cr>
xxxx: ASCII 4-digit decimal number from 0000 to 9999
report: none
- r. Set **Temperature** Limit:
example command: <cr>||OT<cr>
xx: ASCII 2-digit decimal number from 15 to 55 (degrees C)
report: none
- s. Report **Revision** of SCSI Switch’s Firmware:
example command: <cr>||R<cr>
example report: 2059722
- t. **Lock** Serial Ports:
example command: <cr>||OLxxxx<cr>
xxxx: password set with OP command (ASCII 4-digit decimal number from 0000 to 9999)
example report: “||OL1 pass” if password entered correctly, “||OL0 fail” otherwise
- u. **Unlock** Serial Ports:
example command: <cr>||OUxxxx<cr>
xxxx: password set with OP command (ASCII 4-digit decimal number from 0000 to 9999)
example report: “||OU1 pass” if password entered correctly, “||OU0 fail” otherwise
- v. Report **Serial-Port** Lock Status:
example command: <cr>||OS<cr>
example report: “||OS1 lock” if the serial ports are locked, “||OS0 open” otherwise

6 x 4 ELECTRONIC SCSI SWITCH

5.7 ASCII Character Reference for SCSI Switch Box Selection

Switch #	1	2	3	4	5	6	7	8
ASCII		}	~		`	a	b	c
Switch #	9	10	11	12	13	14	15	16
ASCII	d	e	f	g	h	i	j	k
Switch #	17	18	19	20	21	22	23	24
ASCII	l	m	n	o	p	q	r	s
Switch #	25	26	27	28	29	30	31	32
ASCII	t	u	v	w	x	y	z	{

5.8 Graphical User Interface (GUI)

Your SCSI Switch is supplied with control software that is compatible with most recent Microsoft® Windows® operating systems to allow remote control of the switch. Follow instructions on the included CD-ROM to install the software.

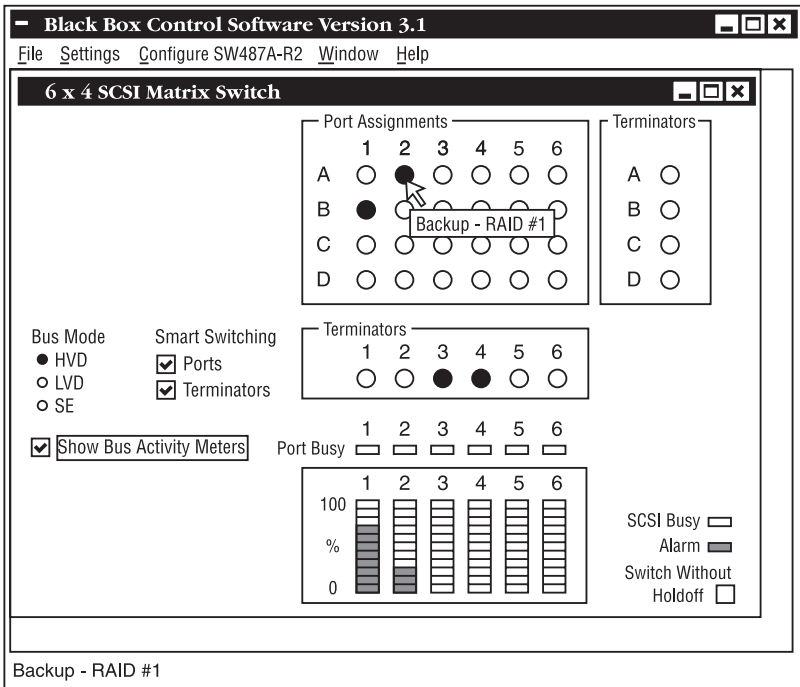


Figure 5-3. The control software's GUI.

5.9 Connecting Multiple SCSI Switches

Up to thirty-two SCSI Switches can be controlled by a single RS-232 serial interface. To operate in this configuration, set the serial ports to operate in daisychained mode. In Figure 5-6, “1” is RS-232 port 1 on each switch and “2” is RS-232 port 2.

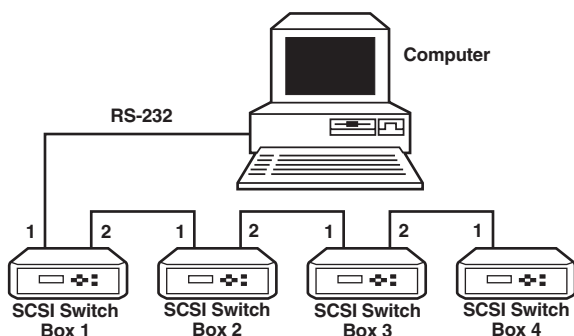


Figure 5-4. Multiple SCSI Switch configuration.

5.10 Rackmount Installation

The 6 x 4 Electronic SCSI Switch can be installed in a standard 19-inch (EIA unit) rack.

5.10.1 INSTALLATION PROCEDURE

Attach the two mounting brackets to each side of the SCSI Switch enclosure using the screws provided. Set the unit into position on the rack, aligning the mounting bracket holes with the rack holes. Use $\frac{5}{8}$ " 10-32 or 12-24 screws to install in the rack.

5.10.2 RACKMOUNT CONSIDERATIONS

1. For proper operation, make sure that the maximum recommended operating ambient temperature of 149°F (65°C) is not exceeded. Keep in mind that if the unit is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Install the rack in an environment compatible with the SCSI Switch's maximum rated operating temperature.
2. Make sure that the amount of airflow around the SCSI Switch that's required for safe operation is not compromised.

6 x 4 ELECTRONIC SCSI SWITCH

3. Make sure that mounting the SCSI Switch in a rack does not cause a hazardous condition because of uneven mechanical loading.
4. Make sure that adding the switch doesn't overload the rack's power circuit.
5. Make sure the power connections of the switch and the other LAN equipment in your rack are properly grounded.

5.11 Typical Applications

Figure 5-5 shows a pair of sample system configurations. Many other configurations are possible.

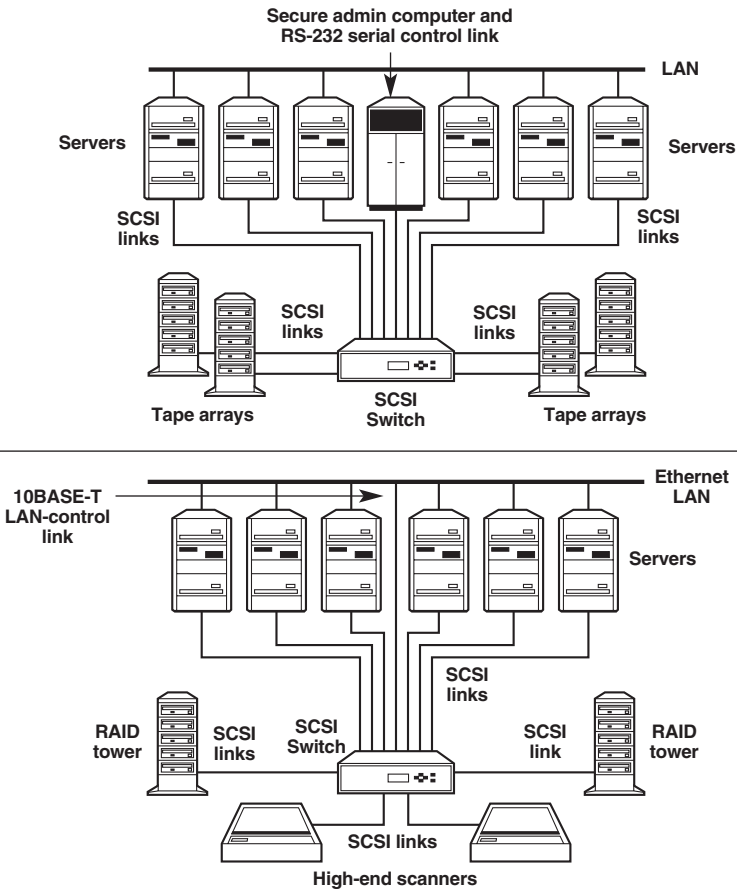


Figure 5-5. Sample applications.

5.12 Network Control of SCSI Switch

The 6 x 4 Electronic SCSI Matrix Switch may be controlled over a TCP/IP network through its LAN port.

5.12.1 LAN-PORT CONFIGURATION

You can remotely control the SCSI Switch through a standard 10-Mbps Ethernet connection running TCP/IP. In the SCSI Switch's factory-default setting, the LAN port will be enabled and the RS-232 COM2 port (which shares the same circuitry and is most often used for daisy chaining SCSI Switches) will be disabled. If you want to daisy chain SCSI Switches, you will need to disable the LAN port and enable the COM2 port. To do this, scroll through the control menus in the switch's front-panel LCD (see **Section 4.3**) until you reach the SET SERIAL PORTS menu. Move the cursor to the DAISY CHAIN option and press ENTER on the switch's keypad to change the setting from N to Y.

5.12.2 APONCFG UTILITY

The apconcfg.exe utility is used to configure the TCP/IP address. This utility is provided on the included CD-ROM. You can reconfigure the IP address by using the IP Configuration Utility. Run apconcfg.exe from the CD-ROM provided with your 6 x 4 Electronic SCSI Switch. A “Configure Network Switch” window will appear. Enter the new IP address and switch MAC address in the appropriate fields. The MAC address can be found on a label located on the bottom of the switch. You can search for the IP address by clicking the search button in the “Configure Black Box Network Switch.” This will bring up a “Search For Black Box Network Switches” window. Enter a beginning IP address, an ending IP address, and click **Search**.

Command strings to control the SCSI Switch may be manually entered through certain versions of HyperTerminal to support connections to IP addresses through the LAN.

NOTE

You will need to specify port #3001 when establishing the connection.

5.12.3 APCONCMD UTILITY

The `apconcmd.exe` utility enables the user to set switch parameters through the LAN port. This utility is located on the CD-ROM provided with your SCSI Switch. To change switch settings and termination for an SCSI Switch, run (at a DOS prompt) `APCONCMD.EXE` from the CD-ROM.

Usage:

```
apconcmd [/?] [/i<IP address>] [/c<COM port>] [/b<baud rate>]
  [/n<Switch number>] [/h<holdoff>] [/x] [/t<termination>]
  [/s<Switch settings>] [/w<command>] [/r<command>]
```

Where:

/? = this message.

/i <IP address> = The IP address of the network-enabled SCSI Switch.

/c <COM port> = The number of the COM port to address (1 to 8; default = 1).

/b <baud rate> = The baud rate of the COM port (2400, 9600, or 19200 [bps]; default = 9600).

/n <Switch number> = The number of the SCSI Switch to change (1 to 32; default = 1).

/h <holdoff> = SCSI-bus holdoff, in seconds. The SCSI Switch will not change the switch settings on a bus until there has been no activity for the specified number of seconds. Valid range is 0 to 25 seconds.

/x = Ignore SCSI-bus activity. Switch settings will be changed immediately.

/t <termination> = Termination can be turned on ("N") or off ("F") for each port (A to D or 1 to 6). For example, "A2NB1F" activates termination for ports A and 2, and it deactivates termination on ports B and 1. Termination on any of the switch's ports that aren't specified in the command will not be affected.

/s<Switch settings> = The settings to be changed. For example, "A1B2NB1A2F" connects ports A1 and B2 and disconnects ports B1 and A2. switch settings on any of the switch's ports that aren't specified in the command will not be affected.

/w<command> = <command> is sent to the switch with no parsing. Any response from the switch is ignored.

/r<command> = <command> is sent to the switch with no parsing. Any response from the switch is displayed on the console's error output.

6. SCSI Technical Information

6.1 SCSI Basics

6.1.1 SCSI-1

The original specification supports data transfers up to 5 MB per second on an 8-bit wide parallel data bus. SCSI-1 standards had some incompatibility problems between host adapters and peripheral devices. The need to improve compatibility, increase transfer rates, and add other features for better performance required a review of the specifications.

6.1.2 SCSI-2

Improved compatibility and higher transfer rates were provided in this enhancement. The addition of "Wide SCSI" permits 16 or 32 bits to be transferred in parallel, the latter requiring two cables. In combination with the "Fast SCSI" option, synchronous data transfers up to 10 MBps for 8-bit, 20 MBps for 16-bit, and 40 MBps for 32-bit buses were achieved.

6.1.3 SCSI-3

The most significant additions include the ability to address up to 32 devices, a 16-bit single-cable data bus, and serial SCSI protocol. The SCSI-3 standard has been split into several subdocuments, including the SCSI Parallel Interface (SPI), which is based on a layered protocol, and the SCSI Interlocked Protocol (SIP), a software link protocol.

6.1.4 SIGNAL WIRING

The signal wiring used in a SCSI bus has an impact on bus performance. The two wiring techniques generally used for SCSI are single-ended and differential. With single-ended wiring, a single wire carries the signal from initiator to target. Single-ended circuitry is not noise-resistant and is generally limited to about 6 meters (20 ft.) at data-transfer speeds of 10 MB per second.

Differential wiring uses two wires for each signal and offers exceptional noise resistance because it does not rely on a common ground. This allows cables up to 25 meters (82 ft.) and reliable operation at 10 MB or more per second. Differential wiring and circuitry is more complex than single-ended and generally tends to be more expensive to implement.

6.1.5 COMMON PROBLEMS

The majority of problems encountered with SCSI-bus installations are due to unbalanced or improper impedances on the SCSI-bus transmission cables caused by varying manufacturers' peripheral devices. SCSI terminators compensate for these inherent impedance mismatches on a SCSI bus where peripheral devices such as hard drives, CD-ROM drives, scanners, or printers are used.

6.1.6 PASSIVE TERMINATORS

The most basic is a passive-resistance style terminator. This is usually supplied with peripherals and frequently does a poor job of balancing the impedance of the SCSI bus. Passive terminators are resistor networks that allow signal voltages to vary with the load and terminator power supplied, resulting in unstable signals from end to end on the bus and causing data errors. Passive terminators are no longer recommended by ANSI for designs.

6.1.7 ACTIVE TERMINATORS

Active terminators add a voltage regulator to the circuit to regulate signal voltages with varying loads and terminator power, allowing a consistent signal to be transmitted everywhere on the bus. This in turn compensates for the varying bus lengths and signal loads. All lines are terminated through 110-ohm resistors, which are applicable to all narrow and wide single-ended applications. Active termination is the minimum ANSI-recommended termination.

6.2 SCSI Installation Tips

- *Keep your SCSI chain short.* Official SCSI specifications limit the length of a SCSI chain to no more than 6 m (20 ft.) for single-ended or 25 m (82 ft.) for differential. Practical experience says the shorter the better. The maximum length you should allow between devices is 3 ft. (0.9 m).
- *Never assign the same SCSI ID number to two devices residing on the same bus.* SCSI uses these numbers as addresses to ensure that information goes to the correct location. Giving two devices the same address can result in lost information.
- *Know that some SCSI-ID numbers may be reassigned.* Internal boot hard drives are usually set to ID "0" while secondary hard drives are set to "1". Motherboards or host adapters are generally set to ID "7".
- *Always terminate the first and last devices on the chain.* Drives purchased specifically for internal use nearly always arrive with terminators installed. If in doubt, call the vendor you purchased the device from.

- *If the last device on the chain has two SCSI connectors, attach the cable to one and a terminator to the other.* Otherwise you'll have an open connector that may cause noise on the SCSI chain.
- *Always turn off the power to your computer and SCSI devices before swapping cables or moving devices around.* SCSI cables contain sensitive data transmission lines and one or more live power wires.
- *Turn on your SCSI devices before you turn on the computer.* Some SCSI devices will not mount if they are not running when you power up your computer. Shutting down your computer first and then the attached SCSI devices allows your system to completely “flush” itself.

6.3 SCSI Interface Signal Descriptions

A total of 18 signals are required for the SCSI interface. These signals are described as follows:

- **BSY (BUSY):** An “OR-tied” signal indicating that the bus is being used.
- **SEL (SELECT):** An “OR-tied” signal used either by an initiator to select a target or by a target to reselect an initiator.
- **C/D (CONTROL/DATA):** A signal driven by a target that indicates whether Control or Data information is on the data bus. True indicates Control.
- **I/O (INPUT/OUTPUT):** A signal driven by a target that controls the direction of data movement on the data bus with respect to an initiator. True indicates input to the initiator. This signal is also used to distinguish between Selection and Reselection phases.
- **MSG (MESSAGE):** A signal driven by a target during the Message phase.
- **REQ (REQUEST):** A signal driven by a target to indicate a request for a REQ/ACK data-transfer handshake.
- **ACK (ACKNOWLEDGE):** A signal driven by an initiator to indicate an acknowledgment for a REQ/ACK data-transfer handshake.
- **ATN (ATTENTION):** A signal driven by an initiator to indicate the Attention condition.
- **RST (RESET):** An “OR-tied” signal that indicates the Reset condition.
- **DB0 through DB15, P, P1 (DATA BUS):** Sixteen data-bit signals and two parity-bit signals that together form a data bus. DB15 is the most significant bit and

has the highest priority during the Arbitration phase. Bit number, significance, and priority decrease downward to DB0. A data bit is defined as a one when the signal value is true and as a zero when the signal value is false. Data parity DBP and DBP1 shall be odd.

**Table 6-1. SCSI connector assignments for single-ended (SE)
16-bit SCSI (wide).**

Signal Name	Pin Number	Signal Name	Pin Number
GROUND	1	-DB12	35
GROUND	2	-DB13	36
GROUND	3	-DB14	37
GROUND	4	-DB15	38
GROUND	5	-DBP1	39
GROUND	6	-DB0	40
GROUND	7	-DB1	41
GROUND	8	-DB2	42
GROUND	9	-DB3	43
GROUND	10	-DB4	44
GROUND	11	-DB5	45
GROUND	12	-DB6	46
GROUND	13	-DB7	47
GROUND	14	-DBP	48
GROUND	15	GROUND	49
GROUND	16	GROUND	50
TERMPWR	17	TERMPWR	51
TERMPWR	18	TERMPWR	52
RESERVED	19	RESERVED	53
GROUND	20	GROUND	54
GROUND	21	-ATN	55
GROUND	22	GROUND	56
GROUND	23	-BSY	57
GROUND	24	-ACK	58
GROUND	25	-RST	59
GROUND	26	-MSG	60
GROUND	27	-SEL	61
GROUND	28	-C/D	62

Table 6-1 (continued). SCSI connector assignments for single-ended (SE) 16-bit SCSI (wide).

Signal Name	Pin Number	Signal Name	Pin Number
GROUND	29	-REQ	63
GROUND	30	-I/O	64
GROUND	31	-DB8	65
GROUND	32	-DB9	66
GROUND	33	-DB10	67
GROUND	34	-DB11	68

Table 6-2. SCSI connector assignments for differential 16-bit SCSI (wide).

Signal Name	Connector Pin Number	Signal Name	Connector Pin Number
+DB(12)	1	-DB(12)	35
+DB(13)	2	-DB(13)	36
+DB(14)	3	-DB(14)	37
+DB(15)	4	-DB(15)	38
+DB(P1)	5	-DB(P1)	39
GROUND	6	GROUND	40
+DB(0)	7	-DB(0)	41
+DB(1)	8	-DB(1)	42
+DB(2)	9	-DB(2)	43
+DB(3)	10	-DB(3)	44
+DB(4)	11	-DB(4)	45
+DB(5)	12	-DB(5)	46
+DB(6)	13	-DB(6)	47
+DB(7)	14	-DB(7)	48
+DB(P)	15	-DB(P)	49
DIFFSENS	16	GROUND	50
TERMPWR	17	TERMPWR	51
TERMPWR	18	TERMPWR	52
RESERVED	19	RESERVED	53
+ATN	20	-ATN	54
GROUND	21	GROUND	55

Table 6-2 (continued). SCSI connector assignments for differential 16-bit SCSI (wide).

Signal Name	Connector Pin Number	Signal Name	Connector Pin Number
+BSY	22	-BSY	56
+ACK	23	-ACK	57
+RST	24	-RST	58
+MSG	25	-MSG	59
+SEL	26	-SEL	60
+C/D	27	-C/D	61
+REQ	28	-REQ	62
+I/O	29	-I/O	63
GROUND	30	GROUND	64
+DB(8)	31	-DB(8)	65
+DB(9)	32	-DB(9)	66
+DB(10)	33	-DB(10)	67
+DB(11)	34	-DB(11)	68

Table 6-3. SCSI connector assignments for low-voltage differential (LVD) 16-bit SCSI (wide).

Signal Name	Connector Pin Number	Signal Name	Connector Pin Number
+DB(12)	1	-DB(12)	35
+DB(13)	2	-DB(13)	36
+DB(14)	3	-DB(14)	37
+DB(15)	4	-DB(15)	38
+DB(P1)	5	-DB(P1)	39
+DB(0)	6	-DB(0)	40
+DB(1)	7	-DB(1)	41
+DB(2)	8	-DB(2)	42
+DB(3)	9	-DB(3)	43
+DB(4)	10	-DB(4)	44
+DB(5)	11	-DB(5)	45
+DB(6)	12	-DB(6)	46
+DB(7)	13	-DB(7)	47

Table 6-3 (continued). SCSI connector assignments for low-voltage differential (LVD) 16-bit SCSI (wide).

Signal Name	Connector Pin Number	Signal Name	Connector Pin Number
+DB(P)	14	-DB(P)	48
GROUND	15	GROUND	49
DIFFSENS	16	GROUND	50
TERMPWR	17	TERMPWR	51
TERMPWR	18	TERMPWR	52
RESERVED	19	RESERVED	53
GROUND	20	GROUND	54
+ATN	21	-ATN	55
GROUND	22	GROUND	56
+BSY	23	-BSY	57
+ACK	24	-ACK	58
+RST	25	-RST	59
+MSG	26	-MSG	60
+SEL	27	-SEL	61
+C/D	28	-C/D	62
+REQ	29	-REQ	63
+I/O	30	-I/O	64
+DB(8)	31	-DB(8)	65
+DB(9)	32	-DB(9)	66
+DB(10)	33	-DB(10)	67
+DB(11)	34	-DB(11)	68

Table 6-4. SCSI speed support map.

STA Term	Maximum Bus Length (M)			Maximum Devices
	SE	HVD	LVD	
SCSI-1	6	25	—	8
Fast SCSI	6	25	—	8
Fast Wide SCSI	6	25	—	16
Ultra SCSI	1.5	25	—	8
Ultra SCSI	3	—	—	4
Wide Ultra SCSI	—	25	—	16
Wide Ultra SCSI	1.5	—	—	8
Wide Ultra SCSI	3	—	—	4
Ultra2 SCSI	N/A	25	25	2
Ultra2 SCSI	N/A	12	12	8
Wide Ultra2 SCSI	N/A	25	25	2
Wide Ultra2 SCSI	N/A	12	12	16

6 x 4 ELECTRONIC SCSI SWITCH

To access jumper options:

Remove the six screws on the bottom of the unit. Then lift off the cover.

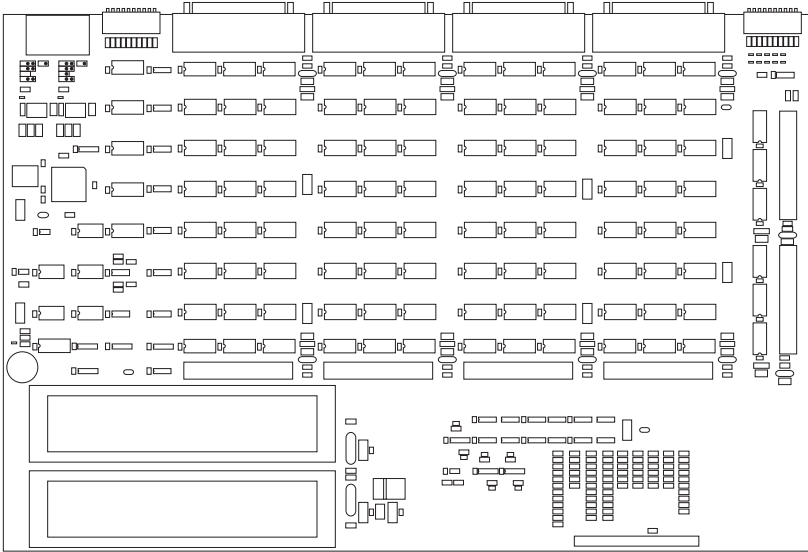


Figure 6-1. SCSI Switch component placement.

- Internal termination jumper block: E1 through E8, E29, E30 (see **Section 5.3**).

7. Troubleshooting

7.1 Calling Black Box

If you determine that your 6 x 4 Electronic SCSI Switch is malfunctioning, *do not attempt to alter or repair the unit*. It contains no user-serviceable parts. Contact Black Box at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem;
- when the problem occurs;
- the components involved in the problem;
- any particular application that, when used, appears to create the problem or make it worse; and
- the results of any testing you've already done.

7.2 Shipping and Packaging

If you need to transport or ship your 6 x 4 Electronic SCSI Switch:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the switch for repair, make sure you include everything that came in the original package. Before you ship, contact Black Box to get a Return Authorization (RA) number.

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